

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

~~Nov Dec 2025~~
FEB 2026

(B. Tech / M. Tech.) Program: Artificial Intelligence & Data Science Scheme :-III

~~Regular~~ **Supp** Examination: SY Semester: III

Course Code: AIC305 and Course Name: Discrete structure for Data Science

Date of Exam: ~~04/12/2025~~ **7/2/26** Duration: 02.5 Hours

Max. Marks: 60

Instructions:

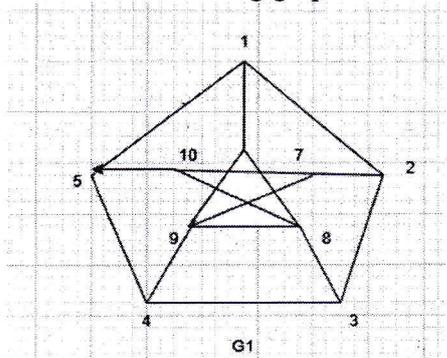
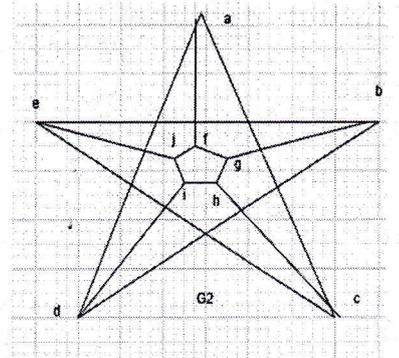
- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT level
Q 1	Solve any two questions out of three: (05 marks each)	10		
a)	Prove that (use law of logic) $((P \vee Q) \wedge \neg (\neg P \wedge (\neg Q \vee \neg R))) \vee (\neg p \wedge \neg Q) \vee (\neg P \wedge \neg R)$ is tautology.		1	Ap
b)	Let $S = \{\text{red, blue, green, yellow}\}$. Determine whether or not each of the following is a partition of S . i) $\{\{\text{red}\}, \{\text{blue, green}\}\}$ ii) $\{\Phi, \{\text{red, blue}\}, \{\text{green, yellow}\}\}$		2	Ap
c)	Draw the Hasse Diagram for the following relation. What the diagram is called as? if remove reflexive edge and transitive edge justify $A = \{a, b, c, d, e\}$ and $R = \{(a, a), (b, b), (c, c), (d, d), (e, e), (a, b), (b, c), (c, d), (d, e), (a, c), (a, d), (a, e), (b, d), (b, e), (c, e)\}$	3	Ap	
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Apply the principle of inclusion and exclusion to find how many positive integers between 1 and 100 are not divisible by 2, 3, or 5?		4	Ap
b)	Consider (2,4) the encoding function $e: B^2 \rightarrow B^6$ define as follows $e(00) = (0000)$ $e(01) = (0110)$ $e(10) = (1011)$ $e(11) = (1100)$ How many error it can detect?		5	Ap
c)	Apply the formula for the maximum number of edges in a simple graph to determine whether a graph with 8 vertices can have 40 edges (excluding self-loops). Show your calculation and justify your answer.	6	Ap	
Q.3	Solve any two questions out of three. (10 marks each)	20		
a)	Use Mathematical Induction to prove the following inequality		1	Ap

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	$n < 2^n$ for all positive integer n.			
b)	Solve the recurrence relation $a_n - 2a_{n-1} + 2a_{n-2} - 2a_{n-3} = 0$		4	Ap
c)	Consider the (2,5) encoding function: $e : B^2 \rightarrow B^5$ defined by $e(00) = 00000$ $e(01) = 10101$ $e(10) = 01110$ $e(11) = 11011$ Show that this encoding function is a group code.		5	Ap
Q.4	Solve any two questions out of three. (10 marks each)	20		
a)	Given $S = \{1,2,3,4\}$ and relation R on S given by $R = \{(4,3), (2,2), (2,1), (3,1), (1,2)\}$. Find the transitive closure of R Warshall's algorithm.		2	Ap
b)	Define Poset. Draw the Hasse diagram, which represent the partial order relation $\{a(a,b) \mid a \text{ divide } b\}$ on the $\{1,2,3,4,6,8,12\}$		3	Ap
c)	Show that following graph is isomorphic. <div style="display: flex; justify-content: space-around; align-items: center;">   </div>		6	Ap
